Childhood sleeping difficulties and depression in adulthood: The 1970 British Cohort Study

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Abstract

Sleeping difficulties in childhood have been associated with an increased risk of depression in adult life but existing studies have not accounted for comorbid maternal sleeping difficulties and depression. This study aimed to determine the association between childhood sleeping difficulties and depression in adulthood after adjusting for the potential confounding influences of maternal depression and sleeping difficulties. Data from the British Cohort Study 1970, a prospective birth cohort with 30 year of follow-up (1975 to 2005) were used. At 5 years of age, 7,437 parents of participants recorded information on whether their child had sleeping difficulties, the frequency of bed wetting, nightmares, maternal depression, and sleep difficulties. At 34 years of age participants reported whether they had received medical treatment for depression in the past year or not. Parental reports of severe sleeping difficulties at 5 years were associated in an increased risk of depression at age 34 years (OR = 1.9, 95% CI 1.2, 3.2) whereas moderate sleeping difficulties were not (OR = 1.1, 95% CI 0.9, 1.3). In conclusion, severe sleeping problems in childhood may be associated with increased susceptibility to depression in adult life.

Keywords: Sleeping difficulties, Children, Depression, Cohort study

Introduction

Difficulties in initiating and maintaining sleep are common, affecting around 30% of children (Spruyt et al., 2005) and have been associated with poor concurrent physical and mental health (Gregory et al., 2005, Gregory et al., 2008). There has, however, been a relative paucity of research on the role of sleep quality in childhood upon mental health in adulthood. A number of studies have demonstrated a link between sleeping difficulties in adolescence and depression in early adulthood (Gregory et al., 2008), or sleep difficulties in childhood and depression in mid-adolescence (Gregory et al., 2005). However, few studies have examined the association between childhood sleep difficulties and depression in later adult life. The two cohorts which have examined this association have produced conflicting results with one reporting that childhood sleep problems were associated with an increased risk for depression in adulthood (Gregory et al., 2008), and the other a null association (Gregory et al., 2005); however, neither accounted for the effect of maternal depression or sleep difficulties. This is important as either could be considered a potential confounder, or mediating factor in the association between childhood sleeping difficulties and the risk of depression in adulthood (O'Connor et al., 2007).

We used data from the 1970 British Cohort Study to examine the association between parental reported sleeping difficulties at 5 years old and the risk of depression in early adulthood (at 34 years). This cohort has detailed assessments of maternal depression and sleeping problems, as well as other sleeping problems such as bedwetting associated with mental health in adulthood (Sadeh, 2005), and other risk factors for depressive symptoms in adult life such as transitions in employment and marital status (Pevalin and Goldberg, 2003).

Methods

The 1970 British Cohort Study is an on-going birth cohort of 17,198 subjects born in the UK between 5th and 7th of April 1970, with five major follow-up studies (Elliott and Shepherd, 2006). The present study utilises data from 1975 (n=13,071), 2000 (n=11,261) and 2004-5 (n=9,656) when data on childhood sleeping difficulties, potential confounds and adult depression were assessed. The cohort has been described in detail elsewhere (Elliott and Shepherd, 2006).

Depression was ascertained at the 34-year follow up by asking two questions. First, participants had to select depression from a showcard list of medical/health conditions that they had suffered since their last interview for which they were currently receiving medical supervision. The second was a further prompt in which the participant was asked "You said you have had depression. Have you suffered from depression in the last year?" Cohort members' sleeping habits were assessed at 5 years through the question "Does your child have sleep difficulties?" (no, yes – mild and yes – severe). Maternal mental health and sleeping/ sleep-related difficulties was assessed using three items form the Rutter Malaise Inventory (Rutter et al., 1970); "Do you often feel miserable and depressed", "Do you feel tired most of the time?" and, "Do you usually have great difficulty in falling asleep or staying asleep?". Other factors which may have influenced sleep quality at five years which may were assessed included: parental reports on the frequency of nightmares and the frequency of bed wetting.

Additional confounders that have been associated with longitudinal associations of poor mental health included; changes in parental situation (none, death of either parent, divorce or other), birth-weight (in pounds), mothers smoking status (smoker or non-smoker) and the English

Picture Vocabulary Test (EPVT), a test of verbal intelligence (standardised Z scores). Parental and achieved social class was defined via the Registrar-General's social classification scheme, based on job title. Transitions in in employment, marital and lifelong limiting illness between 2000 and 2004 were also examined.

Statistical analysis

We used the χ^2 test to examine participant characteristics according to childhood sleeping difficulties. This descriptive analysis undertaken on the complete case dataset. We then modelled the unadjusted then adjusted association between mild and severe childhood sleeping difficulties (with no difficulties as the reference category) and the risk of depression in adulthood in an imputed dataset using multivariate logistic regression.

Multivariate imputation by chained equations (MICE) was carried out to produce 200 imputed data sets (Royston, 2005). The main analysis results were obtained by averaging across the estimates from each of these datasets, taking into account uncertainty so that the standard errors of estimates are appropriately sized. All data were analysed using Stata version 13.

Results

A total of 13,107 surviving cohort members were targeted for recruitment to the 2004 follow up, of which 9,665 retuned the questionnaire. Data on depression was available on 9,656 (73.6% of those invited to participate) and of those 7,830 had taken part in the 1975 follow up, so were included in our analysis. Data on sleeping patterns at 5 years from 12,886 participants with those included in final analysis numbering 7,437 (40.6%). The complete case sample included 5,232

respondents (40.6% of the original cohort). Those providing completing complete data were more likely to be married (74.5% vs 54.1%) and working (68.9% vs. 57.6%), with all other differences being non-significant at the $p<0.05$ level.

Mild sleeping difficulties were reported by 1695 (23.0%) parents; severe difficulties by 95 (1.25%) parents. In total, 524 participants (9.3%) at 34 years of age reported depression that required medical supervision in the previous year, with a higher rate in women than men (13.5% vs. 5.5%). Depression was more common in people who had mild (12.6%) or severe (21.1%) compared with no (11.2%) sleeping difficulties in childhood ($p <0.01$), and those who had mothers who reported feeling depressed (10.8% vs 13.7%, $p<0.001$).

Table 1 shows the characteristics of the cohort members according to sleeping difficulties at 5 years of age. Childhood sleeping difficulties at five years were associated with more frequent nightmares ($p<0.001$); sleep walking ($p<0.001$); bed wetting ($p<0.001$); and maternal tiredness ($p<0.001$) depression ($p<0.001$); and sleeping difficulties ($p<0.001$), as well as transitions in lifelong limiting illness in adulthood ($p=0.017$); but not gender ($p=0.17$); change in parents relationship status ($p=0.47$), mothers' smoking status ($p=0.08$), parental ($p=0.65$) and adult social class ($p=0.38$), transitions in employment ($p=0.99$) or marital status at 34 years of age ($p=0.74$).

Children with severe sleeping difficulties at 5 years of age were at an increased risk of depression at 34-years (unadjusted OR = 2.07, 95% CI = 1.26, 3.42, fully adjusted OR = 1.88, 95% CI = 1.18, 3.16). Transitions in employment, illness and marital status, child gender and

maternal smoking status were strongly associated with depression at 34 in the fully adjusted model. The unadjusted associations between depression at 34 years and verbal intelligence; maternal sleeping difficulties and depression, were attenuated in the fully adjusted models. Child bed wetting and reports of nightmares were not significantly associated with the risk of depression in the unadjusted or fully adjusted models.

Discussion

Severe sleeping difficulties at five years of age, whilst rare, was associated with an increased risk for depression at 34 years. This association remained significant even after accounting for a number of potential confounding factors, including maternal depression and sleep problems, parental social class, other childhood sleep problems (frequent bed wetting, nightmares) and other risk factors for depression in later adult life.

Replicating the results of one cohort study, we found an increased risk for adult depression associated with severe sleeping difficulties in childhood (Gregory et al., 2008). The Zuid-Holland cohort of 1,615 children aged between 4-19, found parental ratings of child sleep using the Child Behaviour Checklist was associated with the increased risk for anxiety/depression, defined as scoring in the top 15% on the anxious/depressed scale of the Young Adult Self-Report, in later life at age 18-32 (Gregory et al., 2008). In contrast, the Dunedin cohort in New Zealand (Gregory et al., 2005), found parent reported sleeping difficulties at 5, 7 and 9 were not associated with major depression and dysthymia on the Diagnostic Interview Schedule at age 21 and 26. Neither study made adjustments for maternal depression nor sleep problems, but analysis

of the Zuid-Holland cohort did, similar to our analysis, did account for other childhood sleeping problems.

The present study has a number of strengths. First, the sample available for analysis was larger and more geographically representative than previous studies. The second relates to the availability of data on a wide range of potential confounders of the relation between childhood sleeping difficulties and adult depression, specifically those on maternal depression and sleeping difficulties. We found the association between severe childhood sleeping difficulties and the risk of depression in later adult life remained after adjustments for maternal depression and sleep problems. Third, is the size and length of the follow-up which allowed associations to be estimated after adolescence, when most previous research has been conducted.

The study does however have some limitations, firstly depression is a recorded via self-report rather than a diagnostic interview, so those classed as depressed may have included participants with a varying severity of symptoms. However, as the question used as for depression which was receiving medical treatment in the past year this will have omitted those who had not yet received a diagnosis. Similarly, as the item only recorded supervision in the past year, earlier depressive episodes occurring outside of the year before interview will have been omitted. These factors suggest that we are likely to have produced an underestimate of the prevalence and lifetime incidence of depression, such that associations reported are likely to be underestimates. Secondly the reporting of sleeping difficulties was through parental report. Better subjective measures such as the Child Sleep Habits Questionnaire (Owens et al., 2000) are available and have been validated. Objective measures of sleep are available through the use of either a

wearable device such as a wrist actigraphy monitor or through sleep laboratories; however, both are costly and time consuming such that they may not bet practical in the scale needed in population level cohorts.

The present study suggests that severe sleeping difficulties in childhood are related to future risk of depression in adulthood. Further research is needed to explore whether screening and the treatment of children for poor sleeping patterns might impact on their mental health in adulthood. Persistent sleep problems are an increasing health concern with c.40% of US adults reporting 'nodding off' and c.7% reporting falling asleep whilst driving. In addition poor sleep in adult hood has been linked with hypertension, diabetes, depression, and obesity, as well as from cancer, increased mortality (Colten and Altevogt, 2006). Therefore, successful identification and treatment for children with sleeping difficulties could, if the association we have identified is causal, have large dividends across many aspects of health in the future.

Conflicts of interest: GG, None; JW, None; AMG, None; DF, None

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Table 1: Descriptive statistics at 5 years (1975) and at 34 years (2004) with estimates on the risk of depression in 3938 men and 3499 women according to parent-reported sleeping difficulties at 5 years

	Parent-reported sleeping difficulties at 5 years of age				Risk of depression at 34 years	
	None N (%)	**Mild** N (%)	**Severe** N (%)	**Missing** N (%)	**Unadjusted Odds ratio (95% CI)**	**Fully adjusted Odds ratio (95% CI)**
Assessed at 5 years of age						
Sleeping difficulties						
None					(ref)	(ref)
Mild					1.13 [0.96,1.33]	1.07 [0.88,1.29]
Severe					2.07 [1.26,3.42] **	1.88 [1.18,3.16] **
Gender						
Male	2901 (74.46)	931 (23.90)	45 (1.16)	19 (0.49)	(ref)	(ref)
Female	2624 (75.84)	764 (22.08)	50 (1.45)	22 (0.64)	2.18 [1.87,2.54] ***	1.851 [1.55,2.21] ***
Maternal tiredness						
No	4054 (77.72)	1097 (21.03)	55 (1.05)	10 (0.19)	(ref)	(ref)
Yes	1416 (69.24)	587 (28.70)	38 (1.86)	4 (0.20)	1.16 [0.99,1.36]	1.006 [0.845,1.198]
Missing	55 (57.89)	11 (11.58)	2 (2.11)	27 (28.42)		
Maternal sleeping difficulties						
No	4885 (76.66)	1405 (22.05)	69 (1.08)	13 (0.20)	(ref)	(ref)
Yes	601 (66.12)	283 (31.33)	24 (2.64)	1 (0.11)	1.38 [1.13,1.68] ***	1.153[0.929,1.431]
Missing	39 (52.00)	7 (9.33)	2 (2.67)	27 (36.00)		
Maternal depression						
No	3899 (78.07)	1039 (20.80)	47 (0.94)	9 (0.18)	(ref)	(ref)
Yes	1545(69.13)	641 (28..68)	44 (1.97)	5 (0.22)	1.30 [1.12,1.51] ***	1.107[0.932,1.315]
Missing	81 (63.78)	15 (11.81)	4 (3.15)	27 (21.26)		
Social class at 5[b]						
Professional	387 (73.43)	136 (25.81)	3 (0.57)	1 (0.19	(ref)	(ref)
Managerial	1117 (74.07)	366 (24.27)	17 (1.13)	8 (0.53	0.83 [0.61,1.14]	0.781[0.562,1.086]
Skilled non-manual	506 (75.64)	150 (22.42)	10 (1.49)	3 (0.45	0.99 [0.70,1.42]	0.878[0.603,1.277]
Skilled Manual	2375 (75.73)	704 (22.45)	43 (1.37)	14 (0.45)	1.09 [0.82,1.45]	0.879 [0.645,1.198]
Partly/un-skilled	850 (76.23)	242 (21.70)	16 (1.43)	7 (0.63)	1.03 [0.75,1.42]	0.780 [0.549,1.107]
Child suffers nightmares						
No	5525 (79.31)	1336 (19.18)	64 (0.92)	41 (0.59)	(ref)	(ref)
Yes	0	339 (91.87)	30 (8.13)	0	1.03 [0.84,1.56]	0.894 [0.624,1.280]
Missing	0	20 (95.24)	1 (4.79)	0		
Child sleep walks						
No	5525 (75.91)	1625 (22.33)	87 (1.20)	41 (0.56)	(ref)	(ref)
Yes	0	50 (87.72)	7 (12.28)	0	1.03 [0.47,2.27]	0.680 [0.286,1.618]

Missing	0	20 (95.24)	1 (4.76)	0		
Wet at night						
No	4458 (75.56)	1363 (23.10)	69 (1.17)	10 (0.17)	(ref)	(ref)
Yes	1062 (74.84)	330 (23.26)	26 (1.83)	1 (0.07)	1.11 [0.93,1.32]	1.040 [0.862,1.254]
Missing	5 (13.51)	2 (5.41)	0	30 (81.08)		
Change in parent relationship						
None	5132 (75.35)	1559 (22.89)	83 (1.22)	37 (0.54)	(ref)	(ref)
Divorce	30 (69.77)	12 (27.91)	1 (2.33)	0	0.82 [0.29,2.30]	0.739[0.255,2.142]
Death	11 (72.15)	42 (26.58)	2 (1.27)	0	1.70 [1.24,2.57]	1.421 [0.915,2.206]
Other	136 (70.83)	49 (25.52)	5 (2.60)	2 (1.04)	2.09 [1.47,2.97]	1.537[1.044,2.262]*
Birth weight						
Normal	5253 (75.47)	1617 (23.23)	90 (1.29)		(ref)	(ref)
Low birth weight	355 (74.42)	115 (24.11)	7 (1.47)		1.229 [0.971, 1.555]	0.970 [0.714,1.318]
Mothers smoking status						
No	3239 (75.59)	972 (22.68)	55 (1.28)	19 (0.44)	(ref)	(ref)
Yes	2102 (74.67)	660 (23.45)	36 (1.28)	17 (0.60)	1.34 [1.16,1.55] ***	1.186 [1.014,1.389] *
Missing	184 (71.88)	63 (24.61)	4 (1.56)	5 (1.95)		
Standardised EVP test (Z score)	5525 (-0.20)	1695 (-0.11)	95 (-0.39)	41 (-1.27)	0.95 [0.90,0.99] *	1.020 [0.965,1.078]
Transitions between age 30 and 34						
Transitions in employment						
Stay employed	4186 (75.33)	1272 (22.89)	68 (1.22)	31 (0.56)	(ref)	(ref)
Become employed	425 (74.43)	138 (24.17)	7 (1.23)	1 (0.18)	1.99 [1.56,2.53] ***	1.559 [1.208,2.012] ***
Become unemployed	411 (75.14)	125 (22.85)	7 (1.28)	4 (0.73)	2.74 [2.18,3.43] ***	2.230 [1.715,2.900] ***
Stay unemployed	488 (74.96)	151 (23.20)	8 (1.23)	4 (0.61)	3.93 [3.24,7.78] ***	2.547 [1.977,3.282] ***
Transitions in long standing illness						
Stay well	3555 (76.22)	1038 (22.26)	48 (1.03)	23 (0.49)	(ref)	(ref)
Become well	459 (76.76)	129 (21.57)	6 (1.00)	4 (0.67)	1.70 [1.30,2.20] ***	1.686 [1.289,2.205] ***
Become unwell	725 (74.13)	232 (23.72)	17 (1.74)	4 (0.41)	2.23 [1.83,2.72] ***	2.079 [1.691,2.557] ***
Stay unwell	768 (70.85)	288 (26.57)	19 (1.75)	9 (0.83)	3.34 [2.80,3.98] ***	2.810 [2.333,3.385] ***
Transitions in marital status						
Stay married	3390 (75.22)	1.037 (23.01)	54 (1.20)	26 (0.58)	(ref)	(ref)
Become married	744 (75.92)	224 (22.86)	9 (0.92)	3 (0.31)	1.09 [0.87,1.38]	1.166 [0.920,1.478]
Become unmarried	358 (73.51)	121 (24.85)	6 (1.23)	2 (0.41)	2.74 [2.17,3.47] ***	2.546 [1.987,3.263] ***
Stay unmarried	983 (74.92)	298 (22.71)	23 (1.75)	8 (0.61)	1.94 [1.63,2.30] ***	1.821 [1.512,2.194] ***
Social Class at 34 [b]						
Professional	304 (75.06)	95 (23.46)	3 (0.74)	3 (0.74)	(ref)	(ref)
Managerial	1814 (74.77)	596 (23.45)	33 (1.36)	10 (0.41)	1.85 [1.17,2.95] *	1.684 [1.053,2.694] *
Skilled non-manual	956 (73.43)	325 (24.96)	14 (1.08)	7 (0.54)	2.49 [1.55,3.99] ***	1.840 [1.136,2.980] *
Skilled Manual	904 (77.20)	241 (20.58)	16 (1.37)	10 (0.85)	2.06 [1.24,3.43] **	1.599 [0.959,2.665]
Partly/un-skilled	606 (77.10)	170 (21.63)	8 (1.02)	2 (0.25)	3.67 [2.30,5.85] ***	1.650 [0.997,2.733]

Missing	941 (74.33)	295 (23.30)	21 (1.66)	9 (0.71)

[a] Fully adjusted model regressed sleeping difficulties against depression at age 34 including all other stated covariates,[b] Social class at 1974 and 2004/2005 classed using Registrar General Classification scheme

***=p<0.05, **=p<0.01 and ***=p<0.001**

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